

Study of Vegetation Cover Using NDVI of Gondia District

1. Prof. H.D. Bhawe, 2. Mr. Kuldip Upasani, 3. Yash Trivedi,
4. Devika Beherkhede, 5. Vidity Jaltare, 6. Aman Singh

¹ Professor, Shri Ramdeobaba College of Engineering and Management, Nagpur, Maharashtra, ² Research Scholar, North Maharashtra University, Jalgaon

^{3,4,5,6} Student, Shri Ramdeobaba College of Engineering and Management, Nagpur, Maharashtra.

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ABSTRACT: This research paper is about to study the vegetation cover of a district (Gondia) by calculating the Normalized Difference Vegetation Index (NDVI) of that district. The study is to see the proportionality of the NDVI with different natural factors like rainfall, soil erosion, replenishment of water bodies, forest cover, barren land/settlements, agricultural cover etc. of the area. Different type of land cover can be determined using NDVI values, as the NDVI values have different range for different type of land cover.

KEYWORDS: ArcGIS, NDVI, Raster, Pre-Monsoon, Post-Monsoon, USGS Earth Explorer, Diva GIS.

I. INTRODUCTION

The investigations were performed as a Case study on Gondia district, with area 5,234 km², of Maharashtra. It lies between 20.39° and 21.38° North latitudes and 79.27° and 80.42° East longitudes. This research paper presents the vegetation cover of the study area by the analysis of Satellite image based on Normalized Difference Vegetation Index (NDVI). NDVI employs the Multi-Spectral Remote Sensing data technique to find Vegetation Index, land cover classification, vegetation, water bodies, agricultural area, thick forest, thin forest with few band combinations of the remote sensed data. Land Resources are easily interpreted by computing their NDVI for Land Cover classifications.

Data from three consecutive years (2018, 2019, and 2020) was taken and analysed in the software called ArcGIS 10.5. The data from each year was analysed for two different periods, pre-monsoon and post-monsoon.

The Simulation results show that the NDVI is highly useful in detecting the surface features of

the visible area which are extremely beneficial for policy makers in decision making. The Vegetation analysis can be helpful in predicting the unfortunate natural disasters to provide humanitarian aid, damage assessment and furthermore to device new protection strategies. Many researchers have reported the use of NDVI for vegetation monitoring.

Vegetation index (VI) is a simple and effective measurement parameter, which is used to indicate the earth surface vegetation covers and crops growth status in remote sensing field. On the basis of wavelength, remote sensing is classified into three types as: visible and reflective infrared remote sensing, thermal infrared remote sensing, and microwave remote sensing. There are several indices for highlighting vegetation bearing areas on a remote sensing scene. NDVI is a common and widely used index.

II. SOFTWARE USED – ARCGIS 10.5

Arc GIS is a family of client software, server software, and online geographical information system (GIS) services developed and maintained by Esri. ArcGIS was first released in 1999 and originally was released as ARC/INFO, a command line-based GIS system for manipulating data. ARC/INFO was later merged into ArcGIS Desktop, which was eventually superseded by ArcGIS Pro in 2015. ArcGIS Pro works in 2D and 3D for cartography and visualization, and includes Artificial Intelligence (AI). ArcGIS is a geographical information system (GIS) software that allows handling and analysing geographic information by visualizing geographical statistics through layer building maps like climate data or trade flows. It is used by a whole host of academic institutions and departments, both in the humanities and sciences, to develop and illustrate ground-

breaking research. Further, it is used by several governments and private/commercial institutions worldwide. The system has the capacity to create geographical information accessible throughout a

company, institution, privately or publicly on the internet. Therefore, the software essentially works as a platform whereby geographical information can be linked, shared and analysed.



III. STUDY AREA:

In this project, the investigations were performed as a case study on the Gondia district of Maharashtra state which has an area of 5,234 km². It lies between 20.39° and 21.38° North latitudes and 79.27° and 80.42° East longitudes. The data of Landsat 8 was downloaded from the <https://earthexplorer.usgs.gov/> for pre and post monsoon periods of three different years (2018,

2019 and 2020). Interpretations of land cover were done with image contrast technique using ArcGIS 10.5 (ArcMap 10.5) software. Information about land use/ land cover classes and associated information was collected and the feature class such as barren land, water bodies, agricultural land and dense forest were recognized for Pre and Post monsoon sessions of all three years.





IV. METHODOLOGY:

Downloaded data from LANDSAT -8 from <https://earthexplorer.usgs.gov/> for Pre and Post Monsoon periods of 3 consecutive years (2018, 2019, and 2020) of Gondia district.

Landsat 8: -

Landsat 8 is an American Earth observation satellite launched on 11 February 2013. It is the eighth satellite in the Landsat program and the seventh to reach orbit successfully.

Landsat 8 is the most recently launched Landsat satellite and carries the Operational Land Imager (OLI) and the Thermal Infrared Sensor (TIRS) instruments.

Landsat data products held in the USGS archives can be searched and downloaded at no charge from a variety of data portals. This page provides information about accessing Landsat Collection 2 and Landsat Collection 1 Level-1 and Level-2 data products.

Mosaicking: -

A mosaic is a combination or merge of two or more images. In QGIS, you can create a single raster dataset from multiple raster datasets by mosaicking them together. Alternatively, you can create a mosaic dataset and create a virtual mosaic from a collection of raster datasets.

The illustration below shows how six adjacent raster datasets are mosaicked together into one raster dataset.



Clipping: -

In GIS, to clip is to overlay a polygon on one or more target features (layers) and extract from the target feature (or features) only the target

feature data that lies within the area outlined by the clip polygon.

A clip operation can be done using raster or vector data.



Geo-referencing: -

Geo-referencing is the name given to the process of transforming a scanned map or aerial photograph so it appears “in place” in GIS. By

associating features on the scanned image with real world x and y coordinates, the software can progressively warp the image so it fits to other spatial datasets.



NDVI Calculation: -

The normalized difference vegetation index (NDVI) is simple graphical indicator that can be used to analyse remote sensing measurements,

often from a space platform, assessing whether or not the target being observed contains live green vegetation.

$$NDVI = \frac{(NIR - Red)}{(NIR + Red)}$$

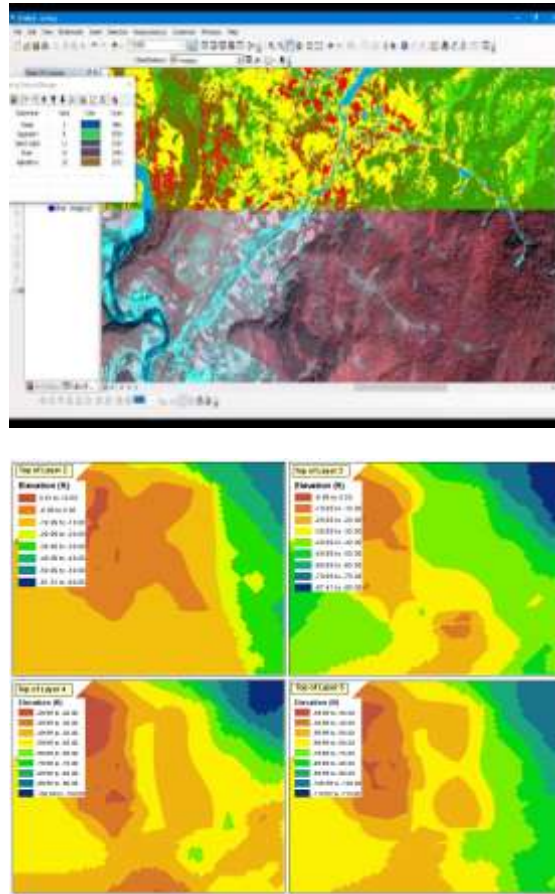
NIR- Near Infrared Reflectance (Band 5 of Landsat 8 data)

RED- Red Visible Reflectance (Band 4 Landsat 8 data).

Reclassification: -

Reclassification is the process of reassigning a value, a range of values, or a list of values in raster to new output tables.

One reason is to set specific values to No Data to exclude them from analysis. Other reasons are to change values in response to new information or classification schemes, or to replace one set of values with an associated set (for example, to replace NDVI values with land type, ex. Barren land, green land & water body). Still another reason is to assign values of preference, priority, sensitivity, or similar criteria to a raster.

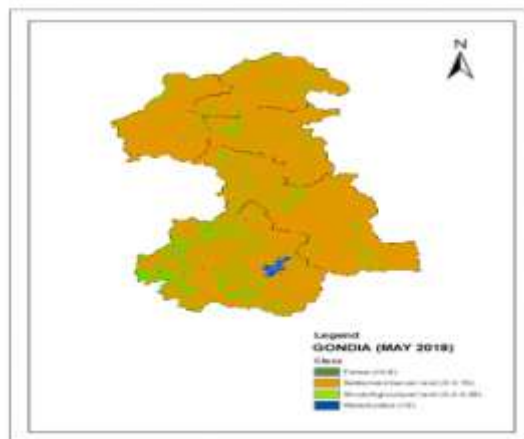


V. OBSERVATIONS AND RESULTS:

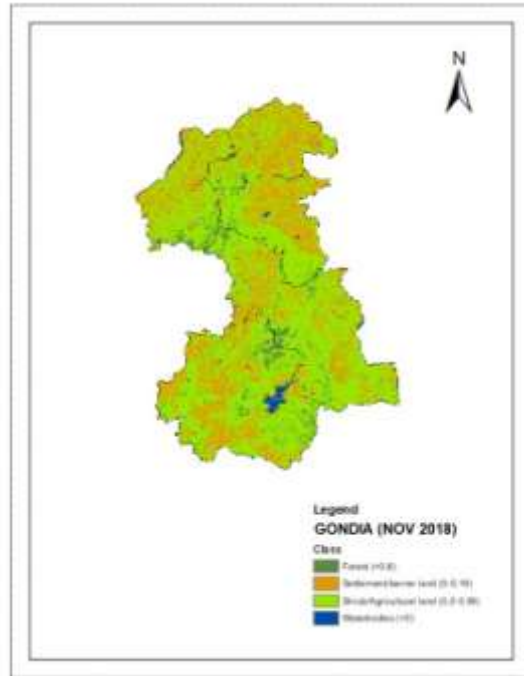
After undergoing the process of calculating NDVI value for Gondia district in Maharashtra, India, from ArcGIS software, we have categorized our project in various comparisons like Year wise comparison for the year of 2018, 2019& 2020 and Taluka-wise

comparison of NDVI data for different years and they are 2018, 2019& 2020. Also, we have considered the data of two different periods from each year that is, pre-monsoon and post-monsoon. The results and conclusion for the same has been given below: -

NDVI Results for year 2018 pre-monsoon: -



NDVI Results for year 2018 post-monsoon: -



NDVI value for the year 2018 has been calculated for Gondia District and based upon it the particular land type i.e., Forest Land, Barren Land/Settlements, Shrub/Agricultural Land and Water Body has been identified and classified as given in the above image.

Legend describes the NDVI values and the characteristics for different features. In other words, on a pixel-by-pixel basis subtracts the value of red band from the value of NIR band and divides

by their sum. Very low value of NDVI (0.2 and below) correspond to barren areas of rock, sand, or snow. Moderate values represent shrub and grassland (0.2 to 0.6), while high value indicates temperate and tropical rainforests (0.6 to 1). Bare soil is represented with NDVI values, which are closest to 0 and water bodies are represented with negative NDVI values.

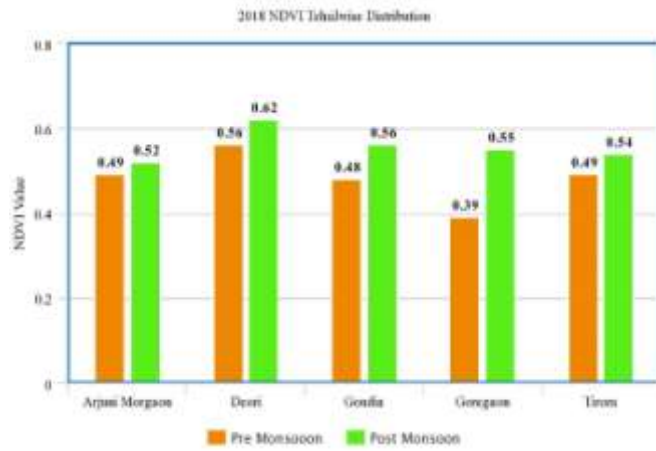
TALUKA-WISE RESULT OF NDVI FOR 2018 PRE AND POST MONSOON: -

Sr. No.	Taluk	Area (Sqkm)	Waterbodies (%)	Shrub/Agriculture (%)	Barren Land/Settlements (%)	Forest (%)	NDVI Value
1	Chakur Mangari	1,453	1	17	80	1%	0.49
2	Dewri	1,123	1%	0	89	1%	0.46
3	Chandoli	981	1%	8	90	1%	0.46
4	Chandrapur	651	1%	1.6	97.1	1%	0.49
5	Wardha	621	1%	1.2	98.1	1%	0.49

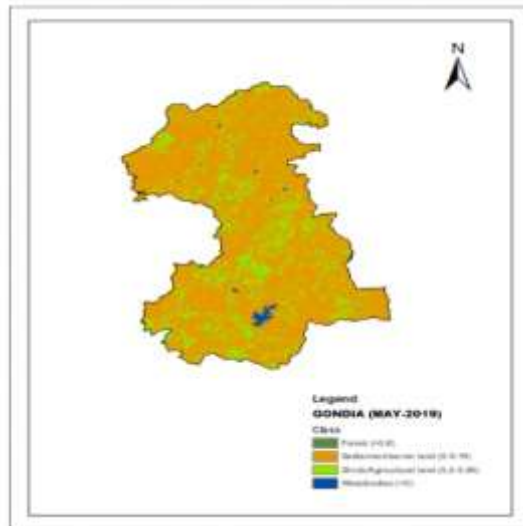
2018 Pre Monsoon

Sr. No.	Taluk	Area (Sqkm)	Waterbodies (%)	Shrub/Agriculture (%)	Barren Land/Settlements (%)	Forest (%)	NDVI Value
1	Chakur Mangari	1,453	1.2	19	80	0.1	0.52
2	Dewri	1,123	0.2	19	80.5	0	0.42
3	Chandoli	981	0.8	24.3	74.9	1.2	0.56
4	Chandrapur	651	0.8	44.3	54.9	2.2	0.69
5	Wardha	621	1.2	50.8	48	4.5	0.58

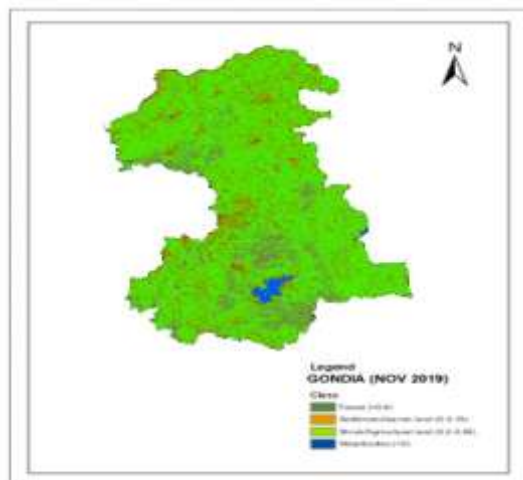
2018 Post Monsoon



NDVI Results for year 2019 pre-monsoon: -



NDVI Results for year 2019 post-monsoon: -



NDVI value for the year 2019 has been calculated for Gondia District and based upon it the particular land type i.e., Forest Land, Barren

Land/Settlements, Shrubs/Agricultural land and Water Body has been identified and classified as given in the above image.

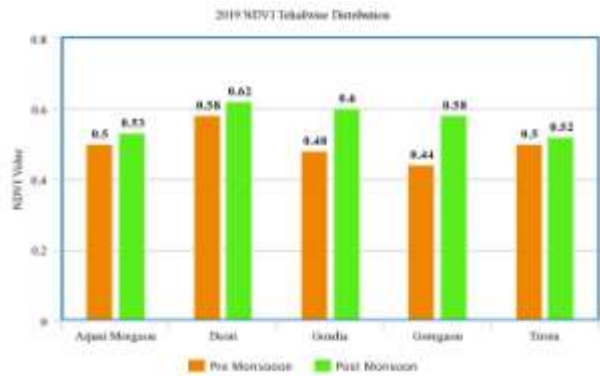
TALUKA-WISE RESULT OF NDVI FOR 2019 PRE AND POST MONSOON: -

No. Taluk	Area (Sqkm)	Waterbodies (%)	Shrubs/Agriculture (%)	Barren land/Settlements (%)	Forest (%)	NDVI Value
1)Ajant Mangason	1,451	1	17	80	1	0.48
2)Dhat	1,123	10	8	80	1	0.58
3)Gondia	981	10	8	80	1	0.48
4)Gangason	811	10	15	80	1	0.48
5)Tansa	641	10	15	80	1	0.48

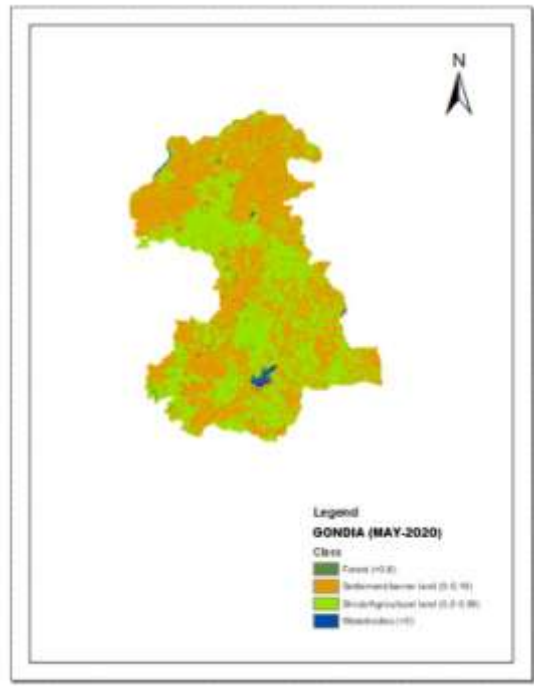
2019 Pre Monsoon

No. Taluk	Area (Sqkm)	Waterbodies (%)	Shrubs/Agriculture (%)	Barren land/Settlements (%)	Forest (%)	NDVI Value
1)Ajant Mangason	1,451	3.3	41.7	11.8	33.6	0.51
2)Dhat	1,123	0.7	17	17.1	1.8	0.61
3)Gondia	981	10	18.8	18.5	1	0.55
4)Gangason	811	0.2	11	11.8	7	0.58
5)Tansa	641	0.8	13.5	17.5	8.5	0.61

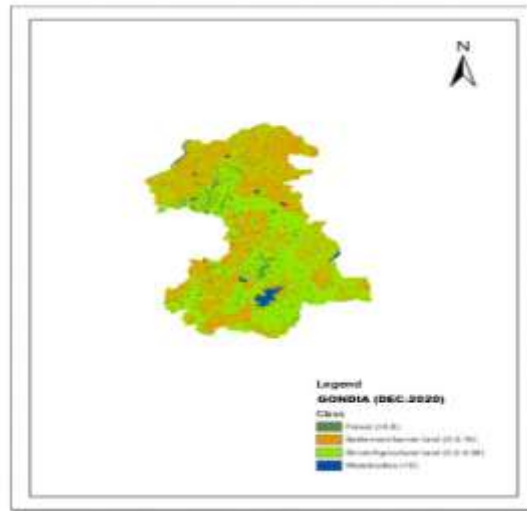
2019 Post Monsoon



NDVI Results for year 2020 pre-monsoon: -



NDVI Results for year 2020 post-monsoon: -



NDVI value for the year 2020 has been calculated for Gondia District and based upon it the particular land type i.e., Forest Land, Barren

Land/Settlements, Shrub/Agricultural land and Water Body has been identified and classified as given in the above image.

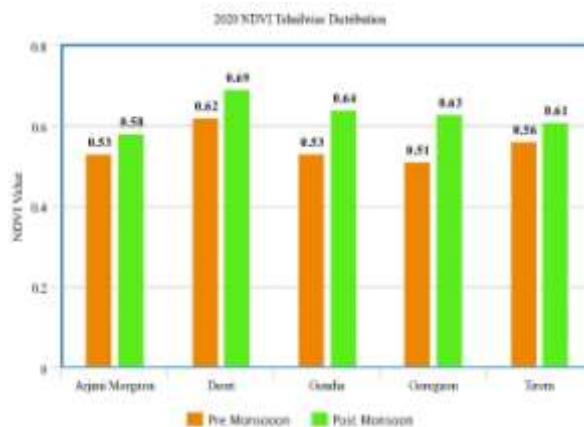
TALUKA-WISE RESULT OF NDVI FOR 2020 PRE AND POST MONSOON: -

Sr. No.	Taluka	Area (sq.km)	Waterbody (%)	Shrub/Agriculture (%)	Barren Land/Settlements (%)	Forest (%)	NDVI Value
1	Ajrao-Malgaj	1,410	1.7	38.4	43.2	9.7	0.61
2	Dant	1,112	0.3	39.4	50.1	9.1	0.62
3	Gondia	585	11.8	38.4	11	18	0.53
4	Goregaon	801	0.3	49.0	53.1	7	0.51
5	Tarn	821	0.7	33.3	46.8	18	0.58

2020 Pre Monsoon

Sr. No.	Taluka	Area (sq.km)	Waterbody (%)	Shrub/Agriculture (%)	Barren Land/Settlements (%)	Forest (%)	NDVI Value
1	Ajrao-Malgaj	1,410	4.1	30.3	50.1	15.5	0.68
2	Dant	1,112	1.1	38.3	37.3	23.3	0.65
3	Gondia	585	1.8	42.1	50	15	0.64
4	Goregaon	801	1.8	50.8	39.7	7.5	0.63
5	Tarn	821	1.7	40.1	46.2	11.9	0.61

2020 Post Monsoon



NDVI RESULTS ACCORDING TO THE YEAR WISE COMPARISON FOR 2018, 2019&2020: -



This bar graph indicates comparison between NDVI value in pre and post monsoon period of Gondia District for Year 2018, 2019& 2020. Here the increase in the NDVI values can be observed from 2018 to 2020 due to increase in rainfall amount from 2018 to 2020 and hence the NDVI value for year 2020 is highest in Gondia district.

VI. CONCLUSION

The potential of NDVI to differentiate between the different types of land covers present in particular area was demonstrated. The NDVI was able to differentiate between the Forest land, Barren land/Settlements, Shrubs/Agricultural land, water bodies and shown the NDVI values of the above four types of classes within the range. NDVI values can be used as predictors in determination of the type of land cover in a particular area; NDVI value is directly proportional to the green land cover and also to the rainfall. Higher the value of NDVI higher will be the chances of green land cover in particular area, and if the area is having green land cover it implies that the rainfall in that area will be more. Also, the NDVI value is inversely proportional to the soil erosion. As we have seen that soil erosion is more in barren land and NDVI value for barren land is less as compared to the green land or forest land. Therefore, lesser will be the value of NDVI more chances of barren land will be there and more will be the soil erosion on such type of land.

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